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(54) Title of Device: Temperature Compensation Circuit of Crystal Oscillator

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SPECIFICATION

1. Title of the Invention

Temperature Compensation Circuit of Crystal Oscillator

2. Scope of Application for Patent Utility Model Correction ex oficio

1. A temperature compensation circuit of a crystal oscillator, including a low-temperature compensation portion and a high-temperature compensation portion connected in series, said low-temperature compensation portion including a thermistor Th1, a resistor R1, and a capacitor C connected in parallel, and said high-temperature compensation portion including a thermistor Th1 and a resistor R2 connected in series and a capacitor C2 connected in parallel, said low-temperature compensation portion and said high-temperature compensation portion being connected in series with a crystal resonator Xtal, wherein a capacitor C2' is connected in parallel with the thermistor Th1 of said high-temperature compensation portion.

3. Detailed Description of the Device

<Object of the Device>

[Field of the Invention]

The present device is a temperature compensation circuit of a direct compensation type crystal oscillator, in which an improvement has been made to the low temperature side.

[Prior Art]

In oscillators using a crystal resonator, if they are adapted to compensate frequency changes caused by temperature changes, there are two types of oscillators. One is an indirect compensation type oscillator, which generates a temperature compensation voltage by a temperature sensing element, such as a thermistor, and applies this voltage to a variable capacitance diode connected in series with a crystal resonator, and the other is a direct compensation type oscillator, which has a crystal resonator connected in series to a capacitor and which also has a temperature sensing element connected in parallel with this capacitor to vary an apparent capacitance thereof. Used in the direct compensation type crystal oscillator is an AT-cut crystal resonator, which is the most often-used crystal resonator. The frequency temperature characteristic of this crystal resonator is of a cubic curve as indicated by the solid line in Fig. 2. Selected for a crystal resonator used to perform direct compensation is one with a cut angle, which has relatively small deviations in the vicinity of normal temperature in line with the characteristic indicated by the solid line in Fig. 2. Under this arrangement, frequency deviations occur in the plus direction on the high-temperature side but swing to the minus side on the low-temperature side, making it possible to perform temperature compensation

separately.

[Problem to be solved by the Device]

In this invention, as the outside dimensions become smaller, frequency deviations on the low-temperature side are likely to take an excessive downturn, and temperature compensation will end up insufficient. Fig. 2 shows a frequency-temperature characteristic of a crystal resonator used in a compensation circuit according to this device as indicated by a broken line. If there is an unbalance in frequency deviation between the high-temperature side and the low-temperature side, it becomes difficult to carry out temperature compensation.

[Purpose of the Device]

This device has as its object to improve the unbalance in frequency deviation between the high-temperature side and the low-temperature side of the crystal resonator.

<Constitution of the Device>

[Means for solving the Problem]

In a temperature compensation circuit of a crystal oscillator, including a temperature compensation portion including a low-temperature compensation portion and a high-temperature compensation portion connected in series, the low-temperature compensation portion having a thermistor Th1 and a resistor R1 connected in parallel and the high-temperature portion having a thermistor Th1 and a resistor R2 connected in

series and a capacitor C2 connected in parallel, the temperature compensation portion being connected in parallel with a capacitor C, wherein a capacitor C2′ is connected in parallel with the thermistor Th1 of the high-temperature compensation portion.

[Function and Embodiment]

Fig. 1 is a temperature compensation circuit of a crystal oscillator according to this device. The crystal oscillator is located on the right side of a crystal resonator Xtal.

The temperature compensation circuit is connected in series with the crystal resonator Xtal. The temperature compensation circuit includes a low-temperature compensation portion and a high-temperature compensation portion, the low-temperature compensation portion including the thermistor Th1, the resistor R1, and the capacitor C connected in parallel, the high-temperature compensation portion including the thermistor Th2 and the resistor R2 connected in series and the capacitor C2 connected in parallel. The low-temperature compensation portion is connected in series with the high-temperature compensation portion. Note that a capacitor Cv is a fine-adjustment capacitor for frequency zero adjustment.

In this device, the capacitor C2′ is connected in parallel to the thermistor Th2 of the high-temperature compensation

portion. The advantage of connecting the capacitor C2' is as follows: in a frequency-temperature characteristic when the crystal resonator is reduced in outside dimensions, for example, in such a case where frequency deviations on the low-temperature side plunged excessively to low levels compared with the frequency rise on the high-temperature side and the frequency characteristic became unbalanced, frequency deviations on he low-temperature side could be raised relative to the high-temperature side. At this time, deviations in the vicinity of normal temperature remain almost unchanged. Therefore, the balance between the high-temperature side and the low-temperature side is improved and it becomes possible to perform temperature compensation as was before, so that it is possible to provide a crystal oscillator with less frequency deviations over a wide temperature range.

<Effect of this Device>

According to this device, in a temperature compensation circuit of a crystal oscillator for temperature compensation in a low-temperature range and a high-temperature range, by connecting a capacitor in parallel with the thermistor in the high-temperature range, it is possible to prevent a sharp lowering of frequency deviation on the low-temperature side that occurs when external size of the crystal resonator is decreased and also prevent the unbalance against frequency rise

on the high-temperature side. As a result, it is possible to provide a temperature compensation circuit for a crystal oscillator, which has less frequency deviations over a wide temperature range.

4. Brief Description of the Drawings

Fig. 1 is a diagram of a temperature compensation circuit for a crystal oscillator; and

Fig. 2 is a diagram showing a frequency-temperature characteristic.

Xtal ... Crystal resonator

Th1, Th2 .... Thermistors

R1, R2 .... Resistors

C, C2, C2' .... Capacitors

Applicant for utility model registration: Kinseki Co., Ltd.

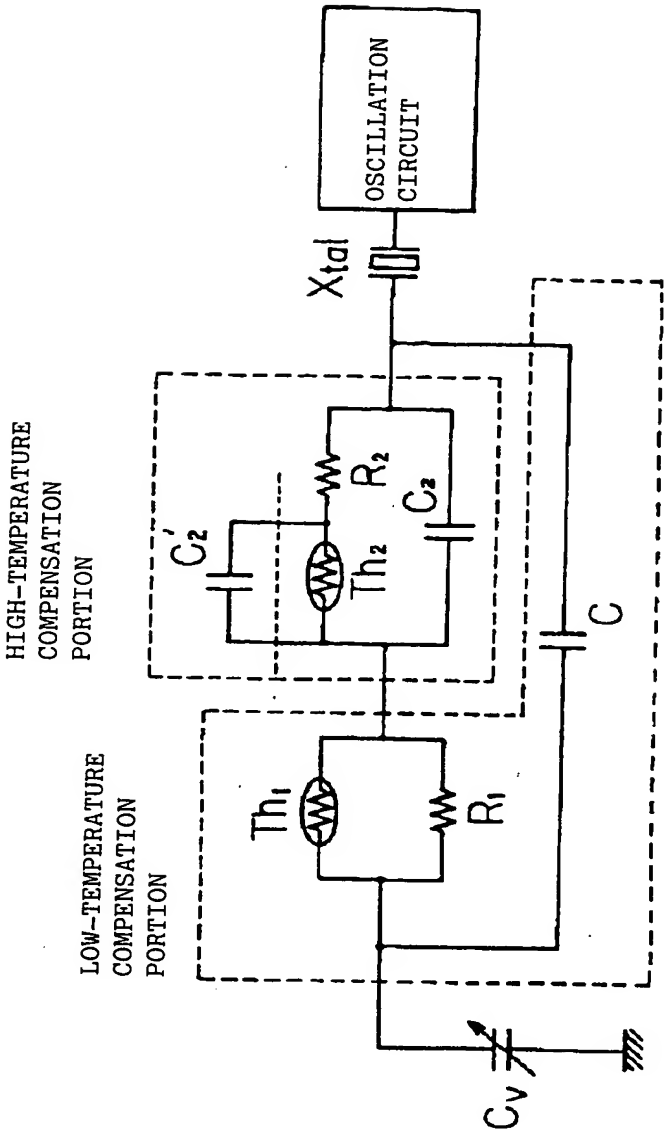

FIG. 1

APPLICANT: KINSEKI CO., LTD.

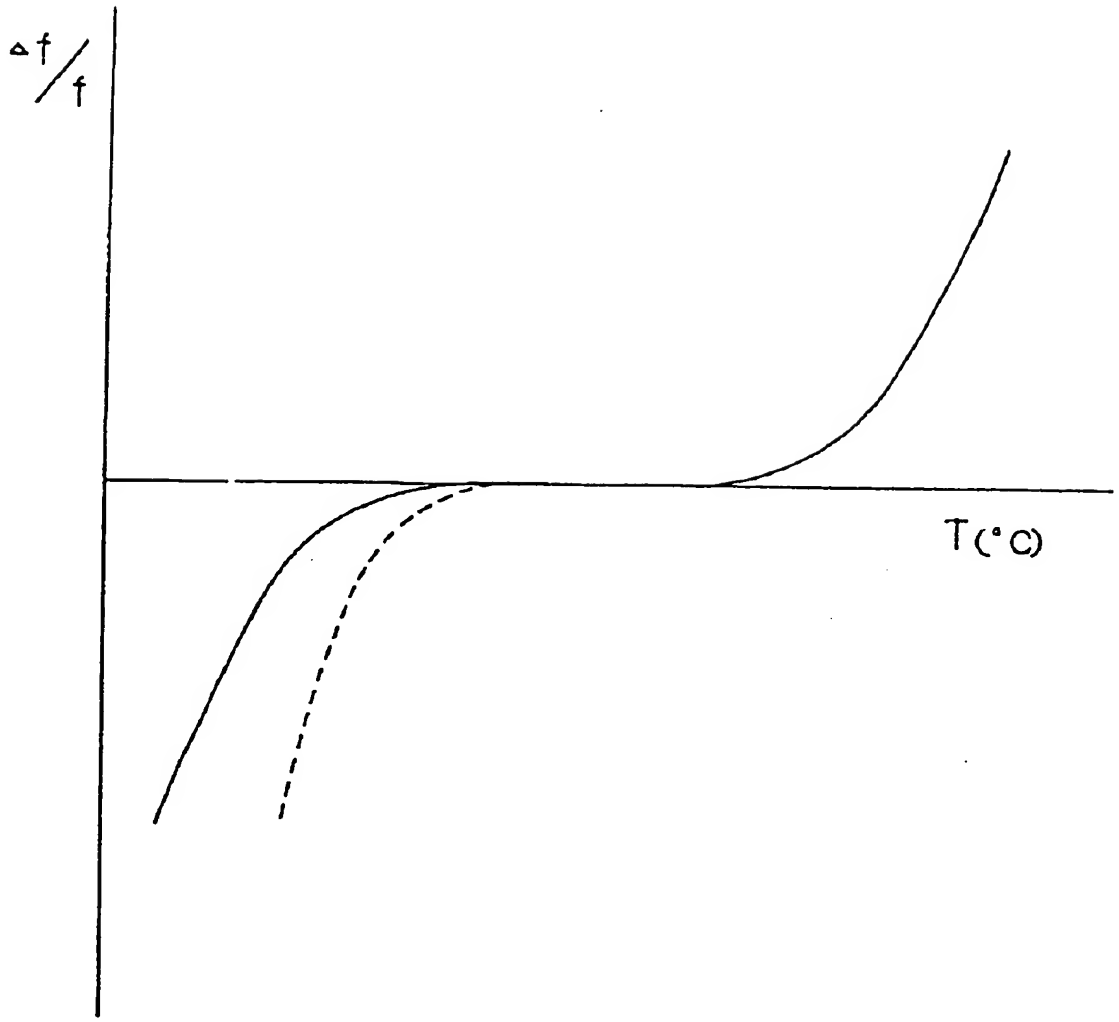

FIG. 2

APPLICANT: KINSEKI CO., LTD.